

Title: Electric motor circuit with overload protection.

The invention relates to an electric motor circuit with overload protection, more in particular for a mirror construction provided with such an electric motor circuit, for use as wing mirror in a vehicle.

An electric motor can become overloaded when its movement is arrested. For example, an electric motor can be used in a motor-foldable wing mirror for a vehicle, as known, for instance, from the Dutch patent application having number 1017466, in which an example of a mechanical design of such a mirror can be found. With a motor-foldable mirror, through operation of a switch in the vehicle, the mirror can, for instance, be brought into an operative position or into a folded-in position in which the mirror is less susceptible to accidents causing damage. An operating circuit enables a motor to be activated in reaction to the switch, preferably by applying a voltage across the motor with a polarity dependent on the desired direction of rotation of the motor.

As wing mirrors sit in exposed positions, there is a considerable risk that the wing mirror during adjustment is restrained for some reason or other. As a result, the risk arises that the motor used for the adjustment sustains damage. Protective measures are required to prevent such damage.

In practice, a number of solutions for protecting an electric motor are known. For instance, the use of a PTC in the operating circuit is known (a PTC is a resistor having a Positive Temperature Coefficient, i.e. an increasing resistance value with increasing temperature). The PTC is included in series with the motor, so that the temperature of the PTC increases when too high a current flows through the motor. That is why the resistance of the PTC also increases. With too high a resistance, the current through the motor is switched off. Such a protective technique has the drawback that the temperature of the PTC decreases only gradually after the overload has gone. As a result, the motor cannot be directly switched on again when the cause of the overload has gone. Further, such a protective technique makes the wing

mirror more complex and susceptible to supply voltage fluctuations. As a result, a margin of safety against such fluctuations has to be maintained which, in turn, increases the electricity consumption of the mirror.

Generally, wing mirrors are exposed to great temperature extremes.

5 On frosty days, the temperature can drop far below zero degrees Celsius while the temperature of the wing mirror in the sun can easily exceed fifty degrees Celsius. This also imposes high demands on the protective circuit which raise the costs of wing mirrors further.

One object of the invention is to provide for an electric motor circuit  
10 which protects the motor from overload and with which, directly upon disappearance of the cause of the overload, the motor can be switched on again.

Another object of the invention is to provide for an electric motor circuit wherein, in a simple manner, the protection is made insensitive to  
15 temperature fluctuations.

It is a further object of the invention to provide for an electric motor circuit with a protection which is effective over a broad temperature range and/or at supply voltages with different polarity.

The invention provides for an electric motor circuit according to  
20 claim 1. It is provided with a relay switch element (for instance a coil-operated switch) in series with the motor. Under normal conditions, the relay switch element is maintained in a conducting position with an exciting coil which is connected in parallel with the motor. When the current through the motor rises because its motion is blocked, a deenergizing coil, included in series with  
25 the motor, switches the relay switch element to a non-conducting position. Thus, a circuit is provided which works with supply voltages of different polarities, and which is robust and little susceptible to temperature fluctuations. Moreover, the circuit is insensitive to supply voltage variations because the deenergizing coil and the exciting coil are operated by the same  
30 supply.

Preferably, a winding of the motor and a winding of the deenergizing coil are wound from material (preferably the same material) having substantially the same resistance temperature dependency, and the windings of the motor and the deenergizing coil are mounted in heat-conducting contact with each other. Thus, the protection is even less susceptible to temperature fluctuations. Preferably, at least the deenergizing coil and the motor are included in the same housing to minimize the temperature dependency. Preferably, also the exciting coil is wound of such material and included in the housing to even further minimize the temperature dependency.

10 Preferably, the relay switch element comprises a single switch whose position is influenced both by the exciting coil and the deenergizing coil. This reduces the costs of the circuit.

15 The exciting coil and the deenergizing coil are preferably included in the circuit whilst wound around a common core, for influencing the relay switch element. This reduces the costs of the circuit.

20 In particular, preferably, a mirror construction for a vehicle is provided with such a circuit. The deenergizing coil is preferably included together with the motor in the housing of the mirror construction, to guarantee the same temperature behavior.

25 These and other objectives and advantageous aspects of the circuit and mirror construction according to the invention will be described further with reference to the following Figures.

30 Fig. 1 shows a wing mirror for a motor vehicle;  
Fig. 2 shows a circuit for controlling the motor of the mirror adjusting mechanism.

35 Fig. 1 shows a mount for a wing mirror for a motor vehicle in cross section. The mount is provided with a fixed part 10 for mounting to a vehicle

(not shown) and a pivotable part 12 which is fitted so as to be pivotable about a shaft 14 relative to fixed part 10. Pivotable part 12 contains mounting holes 16 to which a wing mirror (not shown) for the vehicle is fitted. In the mount, a motor 18 is included which is coupled to a shaft 14 for pivoting the pivotable part relative to the fixed part 10 (for instance with a transverse coupling using a worm wheel (not shown) on the shaft of the motor and a toothed wheel (not shown) on the rotary shaft 14. Pivotable part 12 also forms the housing of motor 18.

5 Motor 18 serves, for example, for adjusting the mirror angle.

10 Motor 18 is switched on when adjusting the position of pivotable part 12 and hence of the mirror (not shown) relative to fixed part 10. When pivotable part 12 reaches its end position, the motor is to be automatically switched off to prevent overload.

15 The construction of such a wing mirror mount and the manner of incorporating therein one or more actuator mechanisms is sufficiently known to the skilled person and will therefore not be further elucidated here. Although only an actuator mechanism for pivotal movement about a substantially vertical axis is shown, it is evident that also other actuator mechanisms for rotations about other axes can be provided. It will also be clear 20 that motor 18 can equally be included in fixed part 10, with fixed part 10 then forming the housing of motor 18.

Fig. 2 shows a circuit for controlling a motor 20, for instance for use in a mirror adjusting mechanism. The circuit has feed connections 21a,b and includes a relay switch 22, a capacitor 24, a resistor 29, a switch-on coil 25, an 25 exciting coil 26 and a deenergizing coil 28. The relay switch 22 is included in series with motor 20 between feed connections 21a,b. Switch-on coil 25 and exciting coil 26 are coupled to relay switch 22 for, at a given polarity of the feed voltage, both applying a force rendering the relay switch 22 conductive. Deenergizing coil 28 is also coupled to relay switch 22, but with a polarization

acting counter to the switch-on coil 25 and exciting coil 26, for applying a force rendering the relay switch 22 non-conductive.

Deenergizing coil 28 is included in series with relay switch 22 and motor 20 between feed connections 21a,b. Capacitor 24 and switch-on coil 25  
5 are included in series with each other and in parallel with the series connection of deenergizing coil 28, relay switch 22 and motor 20 between feed connections 21a,b. Resistor 29 is included in parallel with the series connection of capacitor 24 and switch-on coil 25. Exciting coil 26 is included in series with relay switch 22, but in parallel with motor 20 between feed connections 21a,b.

10 In operation, motor 20 is switched on by providing a step in the supply voltage between feed connections 21a,b, for instance from zero volt to a negative or a positive value. Through the step, temporarily, a current is formed through switch-on coil 25 generating a force which brings the relay switch 22 in a conductive position. The duration of this current is limited by the presence  
15 of capacitor 24 and resistor 29.

When relay switch 22 enters the conductive state, a current starts to flow through motor 20 and through exciting coil 26. The current through the exciting coil 26 leads to a force on relay switch 22 maintaining this relay switch 22 in the conductive position. Consequently, current continues to flow  
20 through motor 20 and exciting coil 26, so that motor 20 adjusts the position of the mirror mechanism.

Deenergizing coil 28 serves for deenergizing relay switch 22 when the mirror mechanism reaches its end position. The current through motor 20 also flows through deenergizing coil 28, which, as a result, generates a force on  
25 relay switch 22. This force is contrary to the force generated by exciting coil 26. Deenergizing coil 28 and exciting coil 26 are dimensioned such that under normal conditions (when motor 20 runs normally) this opposite force is insufficient for bringing the relay switch 22 in the non-conductive position.

However, when the motor, for some reason or other, no longer runs  
30 (for instance because the mirror mechanism has reached its end position, or

because the mechanism is restrained in another manner), the current through motor 20 and deenergizing coil 28 increases. As a result, also the counter-force generated by deenergizing coil 28 increases, resulting in the relay switch 22 being switched into the non-conductive position. As a result, the current 5 through motor 20 fails. Thus, motor 20 is protected from overloading.

It will be clear that the circuit works independently of the polarity of the voltage across feed connections 21a,b. By utilizing both possible polarities, motor 20 can be made to rotate in two mutually opposite directions.

10 The circuit of switch-on coil 25, capacitor 24 and resistor 29, which serves for initially switching on the relay switch 22, is not essential to this protection. Instead of this circuit, other constructions can be used, such as a switch which temporarily bridges relay switch 22, as long as these constructions do not permanently supply current to motor 20.

15 Also, relay switch 22 could be replaced by a series connection of relay switches (not shown) which, through an exciting coil 26 and deenergizing coil 28, respectively, can be switched into a conductive and non-conductive position. However, the use of a single switch which is operated by both exciting coil 26 and deenergizing coil 28 reduces the costs of the switch, the more so because switch-on coil 25 too operates the same relay switch 22.

20 Preferably, exciting coil 26 and deenergizing coil 28 are wound around a common magnetic core (not shown), with which the magnetic field used for switching the relay switch 22 is generated. The invention thus provides for a relay with a relay switch 22 and two or three arrays of windings through which, separately from each other, current can be sent. Preferably, of 25 each array of windings, one extremity is coupled to a common connection of the relay, in such a manner that currents flowing in the same direction through deenergizing coil 28 and exciting coil 26 to this connection, exert a mutually oppositely directed force on the switch.

30 Preferably, switch-on coil 25 too is wound around this core. If switch-on coil 25 is present, it preferably also has an end which is coupled to the

connection, such that currents flowing in the same direction through switch-on coil 25 and exciting coil 26 to this connection exert forces in the same direction on the switch.

Further, preferably, at least deenergizing coil 28 is in heat contact with motor 20, and motor 20 and deenergizing coil 28 contain windings of material having substantially the same resistance temperature dependency. Thus, the protective action of the circuit is screened from temperature sensitivity. Thus, increase of the resistance of the motor does not lead to insufficient current through the deenergizing coil 28, as a result of which the protection would not work. Thus, the deenergizing coil 28 can be designed with a limited margin of safety so that it is possible to minimize losses due to the presence of deenergizing coil 28.

Preferably, at least deenergizing coil 28 and motor 20 are jointly included in one and the same housing, for instance of the mirror construction. Thus, both are exposed to the same temperature influences for screening the protective action of the circuit from temperature sensitivity. Optionally, motor 20 and deenergizing coil 28 could also be included in pivotable part 12 and fixed part 10 of the mirror construction, respectively, or the other way around, so that fixed part 10 and pivotable part 12 together form the housing. In that case too, both are exposed to the same temperature influences outside of the vehicle. Accommodation in one and the same space of the same part (fixed part 10 or pivotable part 12) has the additional advantage that temperature influences coincide even more.

Also the windings of exciting coil 26 are preferably of the same material as the windings of motor 20. This also makes it possible to construct the exciting coil 26 in a manner such that losses due to exciting coil 26 are minimized.